United States Patent [19]

Yamazaki et al.

[11] **4,185,074**

[45] **Jan. 22, 1980**

[54] **CATALYTIC CONVERTER WITH A CATALYST BED SUPPORTER**

[75] Inventors: **Takayuki Yamazaki**, Tokyo; **Takahisa Izumi**, Fujisawa; **Hajime Kawasaki**, Yokohama, all of Japan

[73] Assignee: **Nissan Motor Company, Limited**, Yokohama, Japan

[21] Appl. No.: **783,779**

[22] Filed: **Apr. 1, 1977**

[30] **Foreign Application Priority Data**

Apr. 2, 1976 [JP] Japan ..... 51-41334[U]

[51] **Int. Cl.**[2] **B01J 8/02**; F01N 3/15

[52] **U.S. Cl.** **422/177**; 60/299; 60/301; 422/179

[58] **Field of Search** ..... 23/288 F; 60/299, 301; 248/248, 250; 211/41; 55/DIG. 30; 422/168, 170, 171, 176, 177, 179

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,776,875	1/1957	Howdry	23/288 F
3,801,287	4/1974	Scheitlin et al.	23/288 F
3,809,539	5/1974	Balluff	23/288 F
3,927,984	12/1975	Hartley	23/288 F

Primary Examiner—Michael S. Marcus

Attorney, Agent, or Firm—Schwartz, Jeffery, Schwaab, Mack, Blumenthal & Koch

[57] **ABSTRACT**

A catalyst bed supporter is disposed in a container of a catalytic converter so that it abuts the catalyst bed only when the catalyst bed is subjected to heat expansion. Thus, the catalyst bed is prevented from being excessively expanded even when heated.

8 Claims, 3 Drawing Figures

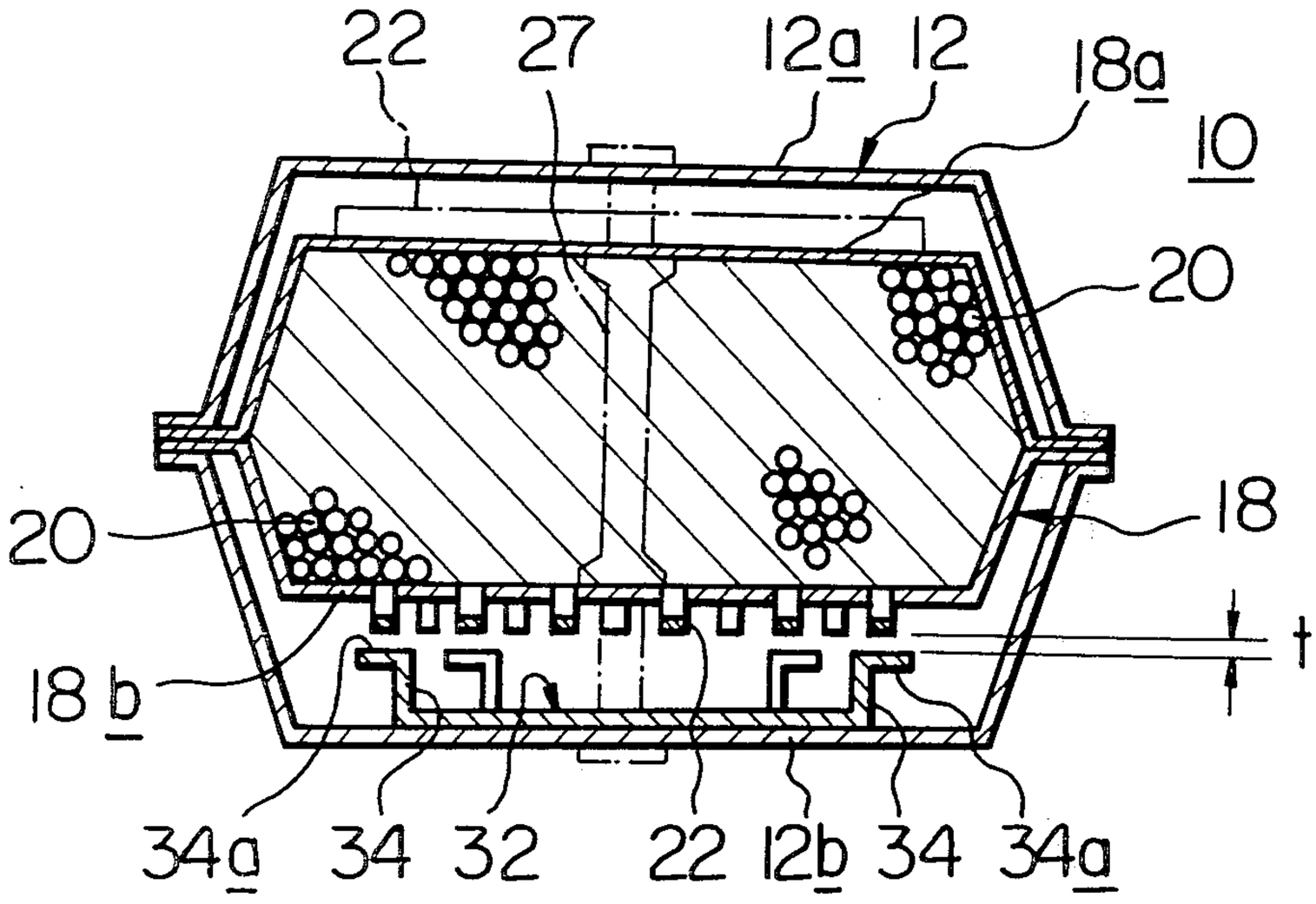


Fig. 1

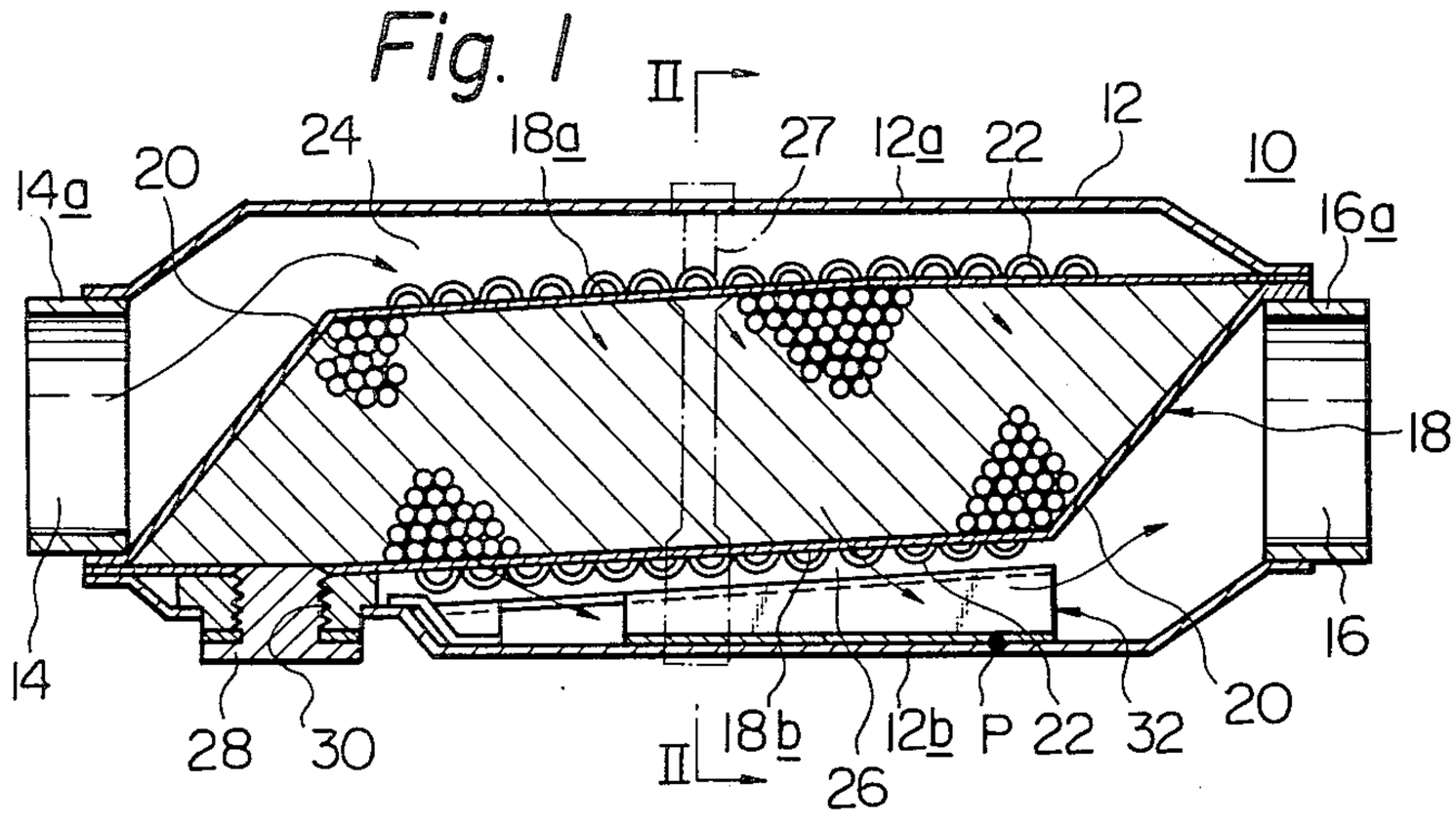


Fig. 2

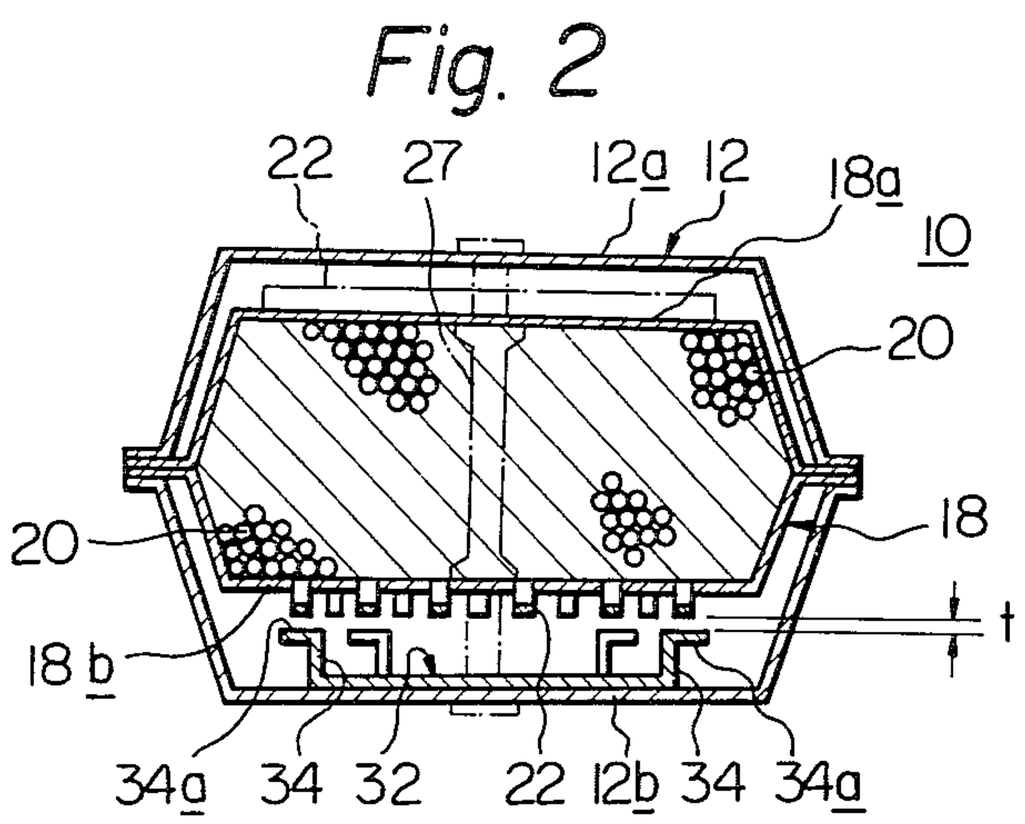
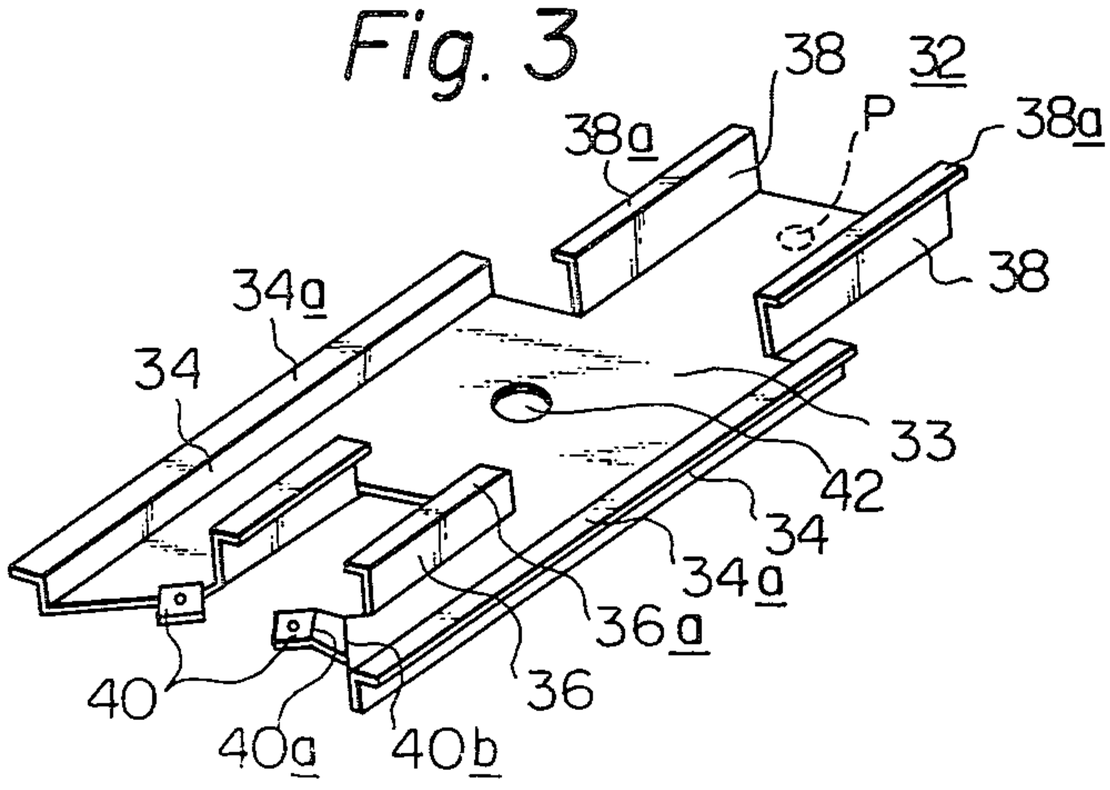


Fig. 3



CATALYTIC CONVERTER WITH A CATALYST BED SUPPORTER

FIELD OF THE INVENTION

The present invention relates in general to a catalytic converter for catalytically treating the exhaust gases emitted from combustion means and more particularly to a catalytic converter having therein a so-called catalyst bed in which a plurality of catalyst pellets are contained or packed.

BACKGROUND OF THE INVENTION

It is sometimes observed in conventional catalytic converters that the catalyst bed is subjected to a sagging phenomenon especially of a portion thereof remote from a portion which is directly connected to some rigid member of the converter. This is because the exothermic reaction of the catalyst pellets gives off a great amount of heat which causes the bed to be heated at a high temperature ranging from about 700° C. to 900° C., so that the bed is subjected to considerable volume expansion. Furthermore, under such high temperatures, the bed is curved or bent downwardly at the unsupported portions thereof because of weight of the catalyst therein. This phenomenon becomes more critical when the catalyst bed is formed with outwardly projecting louvers.

In the case that the catalyst bed is expanded, the catalyst pellets in the bed can become loose thus causing the mutual abrasion of same to produce ultrafine catalyst powder which will cause the so-called secondary air-pollution problem. Furthermore in this case, the flow resistance of the converter is increased because the downstream passage of the converter is critically limited by the sagging of the expanded catalyst bed.

Although stud bolts for firmly connecting the catalyst bed to the container of the converter can be used, the flow resistance of the converter is considerably increased by the provision of same, acting in this instance as flow restrictors.

SUMMARY OF THE INVENTION

Therefore, the present invention proposes to eliminate these drawbacks encountered in the conventional catalytic converter mentioned above.

It is an object of the present invention to provide an improved catalytic converter which has therein means for preventing a catalyst bed from sagging and/or overly expanding even when the bed is excessively heated.

It is another object of the present invention to provide an improved catalytic converter which has therein a catalyst bed and a bed supporting device which abuts the catalyst bed only when the catalyst bed is subjected to heat expansion.

According to the present invention, there is provided a catalytic converter for catalytically treating the exhaust gases emitted from combustion means, the converter comprising: a container having at one end thereof exhaust gas inlet means and at the other end thereof exhaust gas outlet means, the inlet means being adapted to fluidly connect with the combustion means; a catalyst bed disposed in the container to define a chamber between and outer surface of the bed and an inner surface of the container so that the exhaust gases from the inlet means pass through the bed and the chamber before reaching the outlet means, the bed being expanded toward the chamber when heated; and a bed supporting device stationarily disposed in the chamber for supporting the catalyst bed only when the bed is expanded at a predetermined degree due to heat application, whereby the catalyst bed is prevented from excessively thermal expansion when the catalyst bed is excessively heated.

SUMMARY OF THE DRAWINGS

Other objects and advantages of the present invention will become more clearly understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a sectional view of an improved catalytic converter according to the present invention;

FIG. **2** is a sectional view taken along the line II—II of FIG. **1**; and

FIG. **3** is a perspective view of a catalyst bed supporting device employed in the converter of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1** and **2**, particularly to FIG. **1**, there is illustrated an improved catalytic converter of the invention, which is generally designated by the reference numeral **10**. The converter **10** is operatively disposed in an exhaust conduit system of a combustion means such as internal combustion engine (not shown) and generally comprises a container **12** having a generally hexagonal cross section as seen in FIG. **2**. The container **12** consists of an upper shell member **12***a* and a lower shell member **12***b* which are firmly connected at their ridge or flanged edge portions to form a chamber therebetween. The container **12** has an exhaust gas inlet opening **14** at its upstream portion and an exhaust gas outlet opening **16** at its downstream portion. Designated by the numerals **14***a* and **16***a* are respective tubes which are disposed in the inlet and outlet openings **14** and **16**. Within the container **12** is disposed an inclined catalyst bed **18** which has packed therein catalyst pellets **20**. As well shown in FIG. **2**, the catalyst bed **18** has a generally hexagonal cross section and consists of upper and lower vessels **18***a* and **18***b* which are formed with a plurality of louvers **22** extending outwardly away from the corresponding vessels. The louvers **22** contribute substantially to the fluid communication between the interior and the exterior of the bed **18**. The catalyst bed **18** is supported or arranged in the container **12** so as to define upper and lower chambers **24** and **26** in the container **12** which are respectively located between the inlet opening **14** and the upper vessel **18***a* and between the lower vessel **18***b* and the outlet opening **16**. As shown, mounting of the bed **18** in the container **12** is achieved by fixing the ridge portions (no numerals) of the bed **18** to the ridge portions (not numerals) of the container **12** and employing a few stud bolts **27** (though only one stud bolt is illustrated) passed through the container **12** and the catalyst bed **18**. The catalyst bed **18** is inclined longitudinally with respect to the container **12** thus allowing each of the upper and lower chambers **24** and **26** to have a generally wedge shape. Designated by the numeral **28** is a plug which is releasably fixed to an opening **30** of the catalyst bed **18**, the opening **30** being used for changing the catalyst pellets **20**.

Now, according to the present invention, the converter **10** has further a so-called catalyst bed supporting device which is generally designated by the numeral **32**.

The device **32** is so constructed as to abut the catalyst bed for supporting the bed only when the bed **18** is subjected to heat expansion, thus preventing the catalyst bed **18** from undergoing excessive expansion even when the bed is excessively heated during the operation of the converter **10**. This means that the unwanted phenomenon in which the catalyst pellets **20** becomes loose in the bed **18** by the expansion of the bed **18** can be eliminated.

In FIG. **3**, there is shown an example of the supporting device **32**, which is made of some heat resisting material such as stainless steel through metal processing and comprises an elongated channel plate member having a base portion **33** and at its lateral sides upwardly extending flange portions **34**. The free ends of the flange portions **34** are bent substantially normal thereto to form platform portions **34***a*. Preferably, additional flange portions **36** and **38** with platform portions **36***a* and **38***a* are formed to the supporting device, as shown, in addition to the above-mentioned flange portions **34** for improving the supporting function of the device **32**. As well shown in this Figure, a pair of lug portions **40** is provided or formed to one longitudinal end of the member **32**. Each lug portion **40** is bent into two sections **40***a* and **40***b* for the reason as will be described hereinafter.

As well shown in FIG. **1**, the bed supporting device **32** is located in the second chamber **26** of the container **12** in such an arrangement that the flange portions **34, 36** and **38** are substantially parallel to the longitudinal axis of the converter or the direction of the movement of the exhaust gases being passed through the second chamber **26**. The device **32** is tightly connected at a portion designated by "p" and the pair of the lug portions **40** to the lower shell member **12***b* by a conventional fastening technique such as welding and/or bolt fastening. In this embodiment, the lug portions **40** are connected to a portion near the opening **30**. From the foregoing, it will be appreciated that the lug portions **40** are gradually flexed via the bent portions **40***a* and **40***b* as the device **32** is subjected to heat expansion. This means that the heat expansion of the device **32** is substantially absorbed by the flexing or bending of the lug portions **40**. As well seen from FIG. **2**, each of the platform portions **34***a*, **36***a* and **38***a* is illustrated to be spaced from the outer or lower surface of the lower vessel **18***b* at a predetermined distance (t). Preferably, the distance (t) is determined to range from about 0.5 m/m to about 1.0 m/m at ambient temperature (about 20° C. to 30° C.). For keeping the distance at the predetermined degree throughout the entire length thereof, each of the portions **34, 36** and **38** are formed inclined relative to the base **33** as well seen from FIG. **1**. The reason why such distance (t) must be prepared is as follows: First, there is a tendency that if the platform portions **34***a*, **36***a* and **38***a* are firmly abutted against the lower vessel **18***b*, the catalyst bed **18** may be subjected to an extremely large compression force when heated, the force being produced by the upward expansion of the flange portions **34, 36** and **38** of the device **32**. This phenomenon may cause the destruction of the catalyst bed **18**. Second, there is a tendency for the connection between the platform portions **34***a*, **36***a* and **38***a* and the lower vessel **18***b* to close some of the louvers **22**. In this case, the flow resistance of the converter **10** would be considerably increased.

Indicated by the numeral **42** is an opening through which the before-mentioned stud bolt **27** is passed. Usually, the diameter of the opening **42** is larger than that of the stud bolt **27** so that the expansion of the supporting device **32** will not affect the stud bolt **27**. However, this consideration is not needed if another pair of bent lug portions are provided to the other longitudinal end of the channel plate member.

From the above-stated construction of the converter **10** of the present invention, the operation is as follows.

During the operation of the combustion means, the exhaust gases containing therein harmful compounds such as HC and CO are fed into the catalytic converter **10** for the catalytic treatment of same. During this process, the catalytic bed **18** is heated mainly by heat given off by exothermic reaction of the operating catalyst pellets **20**. Thus, the catalytic bed **18** is inevitably expanded. However, when the catalyst bed **18** is expanded to a degree in which the lower surface of the bed **18** abuts the platform portions **34***a*, **36***a* and **38***a*, the expansion of the bed **18**, more particularly the expansion toward the second chamber **26** is stopped. Under such a condition, the catalyst bed **18** maintains its originally set pellet holding capacity even when further heated. Thus, the catalyst pellets **20** in the bed **18** are prevented from becoming loose.

In the present invention, the following several constructional features are provided, which are:

(1) Since the flange portions **34, 36** and **38** are arranged substantially parallel to the direction of the movement of the exhaust gases passed through the lower chamber **26**, the provision of the flange portions does not obstruct the smooth passage of the exhaust gases. This means that the flow resistance of the converter **10** is not critically increased.

(2) Since the bed supporting device **32** is formed to have a so-called heat expansion absorbing means (such as the lug portions **40**), the thermal stress generated in the device **32** is remarkably decreased.

(3) Since the bed supporting device **32** can be made of stainless steel plate through a metal stamping process, the production cost of the device **32** is quite low.

Although in the previous description, the bed supporting device has been described located in the lower chamber **26** in the container **12**, it is also possible to arrange such device in the upper chamber **24** in generally the same manner as described hereinbefore.

What is claimed is:

1. A catalytic converter for catalytically treating the exhaust gases emitted from an engine, comprising:

a. a container having at one end thereof an exhaust gas inlet opening and at the other end thereof a treated gas outlet opening;

b. a catalyst bed disposed in said container to define in said container first and second chambers which are respectively located between said inlet opening and said catalyst bed and between said outlet opening and said catalyst bed so that the exhaust gas fed through said inlet openings passes through said first chamber, the interior of said catalyst bed and said second chamber before discharging through said outlet opening; and

c. a bed supporting device disposed in said second chamber for supporting said catalyst bed only when said catalyst bed is subjected to expansion causing a portion thereof to extend toward said bed supporting device, said bed supporting device comprising an elongated flat main portion with first and second longitudinal ends, said flat main portion being directly secured to said container at a limited portion thereof adjacent said first end, a

plurality of elongated spaced flange portions which perpendicularly project from said flat main portion toward said catalyst bed so as to be engageable with said catalyst bed to support the same when said bed is subjected to expansion, said flange portions being arranged parallel to the flow direction of the treated gases passing through said second chamber, and each of said flange portions comprising at its free end a bent platform portion which is engageable with said catalyst bed upon expansion of said catalyst bed, and at least one lug portion which integrally and flexibly extends from said longitudinal end toward said catalyst bed and is secured at the leading ends thereof to an inwardly raised portion of said container, said lug portion being inclined with respect to the plane substantially defined by said flat main portion, whereby longitudinal expansion of said bed supporting device due to heat is substantially absorbed by flexing of the inclined lug portion.

2. The catalytic converter as claimed in claim **1**, wherein the plane of said platform is parallel to the plane of said elongated flat main portion of said bed supporting device.

3. The catalytic converter as claimed in claim **1**, wherein said elongated flat main portion of said bed supporting device comprises at its generally middle portion an opening through which a stud passing through said container is loosely passed.

4. The catalytic converter as claimed in claim **1**, wherein the height of said elongated flange is gradually changed throughout the entire longitudinal length thereof so as to accommodate with the configuration of said second chamber.

5. The catalytic converter as claimed in claim **1**, wherein said lug portion extends toward said catalyst bed.

6. The catalytic converter as claimed in claim **1**, comprising two said lug portions in spaced relationship.

7. The catalytic converter as claimed in claim **1**, wherein said bed supporting device is arranged so that the longitudinal axis thereof is parallel to the flow direction of the treated gases passing through said second chamber.

8. The catalytic converter as claimed in claim **7**, wherein said first and second ends of said elongated flat main portion are located near said outlet opening and said inlet opening, respectively.

* * * * *